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| 09/808,484 | 03/14/2001 | Kelly T. Hurley | MIO 0064 PA | 3606 |

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EXAMINER

QUINTO, KEVIN V

ART UNIT

PAPER NUMBER

2826

DATE MAILED: 08/27/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|-------------------------------|-------------------------------|--|
| Office Action Summary | Application No. 09/808,484 | Applicant(s) HURLEY ET AL. | |
| | Examiner Kevin Quinto | Art Unit 2826 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 July 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 12,19-22,24,25,33,34,36-38,40,73,74 and 76 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 12,19-22,24,25,33,34,36-38,40,73,74 and 76 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 14 March 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>20030728</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

1. Applicant's arguments with respect to claims 12, 19-22, 24, 25, 33, 34, 36-38, 40, 73, 74, and 76 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (USPN 5,770,501) in view of Shih et al. (USPN 6,362,035 B1) and further in view of Vassiliev et al. (USPN 6,180,490 B1) and further in view of Yoo et al. (USPN 5,747,848).

4. In reference to claim 12, figures 6a-6f of Hong (USPN 5,770,501) disclose a device which meets the claim. Figures 6a-6f illustrate a substrate (50) with at least one semiconductor layer (50). There is at least one trench formed in the substrate (50). There is a field oxide (542) inside the at least one trench and it extends above an upper surface of the substrate (50). A tunnel oxide layer (512) is formed over at least a portion of the substrate (50). There is at least one floating gate layer (514a) formed

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over the tunnel oxide layer (512). There is at least one polysilicon ear (552) formed on the at least one floating gate layer (514a) and is adjacent to the field oxide (542). Hong does not disclose the use of a sloped isolation trench. However the use of a sloped isolation trench in a nonvolatile semiconductor device is well known in the art. Shih et al. (USPN 6,362,035 B1, hereinafter referred to as the "Shih" reference) discloses that using a sloped isolation trench prevents the formation of voids in the isolation material within the trench (column 3, lines 52-55). Furthermore Vassiliev et al. (USPN 6,180,490 B1, hereinafter referred to as the "Vassiliev" reference) discloses that the presence of voids can lead to an undesired electrical shorting (column 2, lines 16-22). In view of Shih and Vassiliev, it would therefore be obvious to use sloped isolation trenches in the device of Hong. Hong does not disclose the use of a conductive bit line which is connected to the drain of each memory cell in a row in conjunction with a common source line, otherwise known as the NOR configuration. However it is well known in the art to implement a flash memory in this manner. Yoo et al. (USPN 5,747,848) discloses that NOR-type devices have a higher speed than NAND-type devices (column 1, lines 28-32). It would therefore be obvious to implement the device of Hong with a common source line and a conductive bit line that is connected to the drain of each memory cell in a row in order to attain the benefit of a high speed memory.

5. Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (USPN 5,770,501) in view of Shih et al. (USPN 6,362,035 B1) and further in view of Vassiliev et al. (USPN 6,180,490 B1) and further in view of Yoo et al. (USPN 5,747,848).

6. With regard to claim 19, figures 6a-6f of Hong disclose a device which meets the claim. Figures 6a-6f illustrate a substrate (50) with at least one semiconductor layer (50). There is a plurality of trenches formed in the substrate (50). A field oxide (542) is inside each of the trenches. A tunnel oxide layer (512) is formed over the substrate (50). A floating gate layer (514a) is formed over the tunnel oxide layer (512). A pair of polysilicon ears (552) are formed adjacent to the field oxide regions (542) on the floating gate layer (514a). The polysilicon ears (552) are projecting substantially perpendicular to the upper surface of the floating gate layer (514a). Hong does not disclose the use of a sloped isolation trench. However the use of a sloped isolation trench in a nonvolatile semiconductor device is well known in the art. Shih (USPN 6,362,035 B1) discloses that using a sloped isolation trench prevents the formation of voids in the isolation material within the trench (column 3, lines 52-55). Furthermore Vassiliev (USPN 6,180,490 B1) discloses that the presence of voids can lead to an undesired electrical shorting (column 2, lines 16-22). In view of Shih and Vassiliev, it would therefore be obvious to use sloped isolation trenches in the device of Hong. Hong does not disclose the use of a conductive bit line which is connected to the drain of each memory cell in a row in conjunction with a common source line, otherwise known as the NOR configuration. However it is well known in the art to implement a flash memory in this manner. Yoo et al. (USPN 5,747,848) discloses that NOR-type devices have a higher speed than NAND-type devices (column 1, lines 28-32). It would therefore be obvious to implement the device of Hong with a common source line and a conductive bit line

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that is connected to the drain of each memory cell in a row in order to attain the benefit of a high speed memory.

7. In reference to claim 20, Hong meets the limitation of the claim. Figures 6a-6f shows that the floating gate layer (514a) comprises a plurality of floating gates and a corresponding pair of polysilicon ears for each of the plurality of floating gates.

8. Claims 21 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (USPN 5,770,501) in view of Shih et al. (USPN 6,362,035 B1) and further in view of Vassiliev et al. (USPN 6,180,490 B1) and further in view of Yoo et al. (USPN 5,747,848).

9. In reference to claim 21, figures 6a-6f of Hong disclose a device which meets the claim. Figures 6a-6f illustrate a substrate (50) with at least one semiconductor layer (50). There is a plurality of trenches formed in the substrate (50). A field oxide (542) is inside each of the trenches. A tunnel oxide layer (512) is formed over the substrate (50). A floating gate layer (514a) is formed over the tunnel oxide layer (512). A pair of polysilicon ears (552) are formed adjacent to a portion of the floating gate (514a). Hong does not disclose the use of a sloped isolation trench. However the use of a sloped isolation trench in a nonvolatile semiconductor device is well known in the art. Shih (USPN 6,362,035 B1) discloses that using a sloped isolation trench prevents the formation of voids in the isolation material within the trench (column 3, lines 52-55). Furthermore Vassiliev (USPN 6,180,490 B1) discloses that the presence of voids can lead to an undesired electrical shorting (column 2, lines 16-22). In view of Shih and Vassiliev, it would therefore be obvious to use sloped isolation trenches in the device of

Hong. Hong does not disclose the use of a conductive bit line which is connected to the drain of each memory cell in a row in conjunction with a common source line, otherwise known as the NOR configuration. However it is well known in the art to implement a flash memory in this manner. Yoo et al. (USPN 5,747,848) discloses that NOR-type devices have a higher speed than NAND-type devices (column 1, lines 28-32). It would therefore be obvious to implement the device of Hong with a common source line and a conductive bit line that is connected to the drain of each memory cell in a row in order to attain the benefit of a high speed memory.

10. In reference to claim 22, Hong meets the limitation of the claim. Figures 6a-6f shows that the floating gate layer (514a) comprises a plurality of floating gates and a corresponding pair of polysilicon ears for each of the plurality of floating gates.

11. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (USPN 5,770,501) in view of Shih et al. (USPN 6,362,035 B1) and further in view of Vassiliev et al. (USPN 6,180,490 B1) and further in view of Yoo et al. (USPN 5,747,848).

12. In reference to claim 24, figures 6a-6f and 7 of Hong (USPN 5,770,501) disclose a device which meets the claim. Figures 6a-6f and 7 illustrate a substrate (50) with at least one semiconductor layer (50). There is at least one trench formed in the substrate (50). There is a source and a drain (572, both of them) formed in the substrate (50). There is a field oxide (542) inside a trench and it extends above an upper surface of the substrate (50). A tunnel oxide layer (512) is formed over at least a portion of the substrate (50). There is at least one floating gate layer (514a) formed over the tunnel

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oxide layer (512). There is at least one polysilicon ear (552) formed on the at least one floating gate layer (514a) and is adjacent to the field oxide (542). There is a dielectric layer (562) formed over the substrate (50) and the floating gate layer (514a). There is a control gate layer (564(a)) formed over the dielectric layer (562). Hong does not disclose the use of a sloped isolation trench. However the use of a sloped isolation trench in a nonvolatile semiconductor device is well known in the art. Shih (USPN 6,362,035 B1) discloses that using a sloped isolation trench prevents the formation of voids in the isolation material within the trench (column 3, lines 52-55). Furthermore Vassiliev (USPN 6,180,490 B1) discloses that the presence of voids can lead to an undesired electrical shorting (column 2, lines 16-22). In view of Shih and Vassiliev, it would therefore be obvious to use sloped isolation trenches in the device of Hong. Hong does not disclose the use of a conductive bit line which is connected to the drain of each memory cell in a row in conjunction with a common source line, otherwise known as the NOR configuration. However it is well known in the art to implement a flash memory in this manner. Yoo et al. (USPN 5,747,848) discloses that NOR-type devices have a higher speed than NAND-type devices (column 1, lines 28-32). It would therefore be obvious to implement the device of Hong with a common source line and a conductive bit line that is connected to the drain of each memory cell in a row in order to attain the benefit of a high speed memory.

13. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (USPN 5,770,501) in view of Shih et al. (USPN 6,362,035 B1) and further in view of

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Vassiliev et al. (USPN 6,180,490 B1) and further in view of Yoo et al. (USPN 5,747,848).

14. In reference to claim 25, figures 6a-6f and 7 of Hong (USPN 5,770,501) disclose a device which meets the claim. Figures 6a-6f and 7 illustrate a substrate (50) with at least one semiconductor layer (50). There is at least one trench formed in the substrate (50). There is a source and a drain (572, both of them) formed in the substrate (50). A tunnel oxide layer (512) is formed over at least a portion of the substrate (50). There is at least one floating gate layer (514a) formed over the tunnel oxide layer (512). There is a field oxide (542) inside a trench. There is at least one polysilicon ear (552) formed on the at least one floating gate layer (514a). There is a dielectric layer (562) formed over the substrate (50) and the floating gate layer (514a). There is a control gate layer (564(a)) formed over the dielectric layer (562). Hong does not disclose the use of a sloped isolation trench. However the use of a sloped isolation trench in a nonvolatile semiconductor device is well known in the art. Shih (USPN 6,362,035 B1) discloses that using a sloped isolation trench prevents the formation of voids in the isolation material within the trench (column 3, lines 52-55). Furthermore Vassiliev (USPN 6,180,490 B1) discloses that the presence of voids can lead to an undesired electrical shorting (column 2, lines 16-22). In view of Shih and Vassiliev, it would therefore be obvious to use sloped isolation trenches in the device of Hong. Hong does not disclose the use of a conductive bit line which is connected to the drain of each memory cell in a row in conjunction with a common source line, otherwise known as the NOR configuration. However it is well known in the art to implement a flash memory in this

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manner. Yoo et al. (USPN 5,747,848) discloses that NOR-type devices have a higher speed than NAND-type devices (column 1, lines 28-32). It would therefore be obvious to implement the device of Hong with a common source line and a conductive bit line that is connected to the drain of each memory cell in a row in order to attain the benefit of a high speed memory.

15. Claims 33, 34, and 36-38 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (USPN 5,770,501) in view of Shih et al. (USPN 6,362,035 B1) and further in view of Vassiliev et al. (USPN 6,180,490 B1) and further in view of Yoo et al. (USPN 5,747,848).

16. With regard to claims 33 and 34, figures 6a-6f and 7 of Hong (USPN 5,770,501) disclose a device which meets these claims. Figures 6a-6f and 7 illustrate a device with a source and a drain (572, both of them) formed in a substrate (50). There is a floating gate (514a) formed over the substrate (50). There is a field oxide (542) formed in a trench in the substrate (50). There is a polysilicon ear (552) formed over the substrate (50). There is a dielectric layer (562) formed over the substrate (50) and the floating gate layer (514a). There is a control gate layer (564(a)) formed over the dielectric layer (562). Hong does not disclose the use of a sloped isolation trench. However the use of a sloped isolation trench in a nonvolatile semiconductor device is well known in the art. Shih (USPN 6,362,035 B1) discloses that using a sloped isolation trench prevents the formation of voids in the isolation material within the trench (column 3, lines 52-55). Furthermore Vassiliev (USPN 6,180,490 B1) discloses that the presence of voids can lead to an undesired electrical shorting (column 2, lines 16-22). In view of Shih and

Vassiliev, it would therefore be obvious to use sloped isolation trenches in the device of Hong. Hong does not disclose the use of a conductive bit line which is connected to the drain of each memory cell in a row in conjunction with a common source line, otherwise known as the NOR configuration. However it is well known in the art to implement a flash memory in this manner. Yoo et al. (USPN 5,747,848) discloses that NOR-type devices have a higher speed than NAND-type devices (column 1, lines 28-32). It would therefore be obvious to implement the device of Hong with a common source line and a conductive bit line that is connected to the drain of each memory cell in a row in order to attain the benefit of a high speed memory.

17. In reference to claim 36, figures 6a-6f of Hong show that the ear (552) extends beyond the bounds of the floating gate (514a).

18. In reference to claim 37, figures 6a-6f of Hong show that the near vertical sides of the ear (552) do not contact the floating gate (514a).

19. With regard to claim 38, figures 6a-6f of Hong show that the near vertical edge of the ear (552) is adjacent to the field oxide (542) while the bottom edge of the ear (552) is adjacent to the floating gate (514a).

20. Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (USPN 5,770,501) in view of Shih et al. (USPN 6,362,035 B1) and further in view of Vassiliev et al. (USPN 6,180,490 B1) and further in view of Yoo et al. (USPN 5,747,848).

21. In reference to claim 40, figures 5, 6a-6f and 7 of Hong (USPN 5,770,501) disclose a device which meets the claim. Figures 5, 6a-6f and 7 illustrate a substrate

(50) with a source and a drain (572, both of them). It is understood that the source and the drain are formed in common regions with adjacent memory cells. There is a floating gate layer (514a) with a pair of polysilicon ears (552) in a trench. Hong does not disclose the use of a sloped isolation trench. However the use of a sloped isolation trench in a nonvolatile semiconductor device is well known in the art. Shih (USPN 6,362,035 B1) discloses that using a sloped isolation trench prevents the formation of voids in the isolation material within the trench (column 3, lines 52-55). Furthermore Vassiliev (USPN 6,180,490 B1) discloses that the presence of voids can lead to an undesired electrical shorting (column 2, lines 16-22). In view of Shih and Vassiliev, it would therefore be obvious to use sloped isolation trenches in the device of Hong. There is a control gate (564(a)) associated with each row. Figure 5 shows that the control gate layer (564(a)) is formed as a common word line which is associated with each row. It is understood that the control gate is formed integral with the word line since Hong interchangeably uses the terms "control gate" and "word lines" (column 3, lines 48-51). Hong does not disclose the use of a conductive bit line which is connected to the drain of each memory cell in a row in conjunction with a common source line, otherwise known as the NOR configuration. However it is well known in the art to implement a flash memory in this manner. Yoo et al. (USPN 5,747,848) discloses that NOR-type devices have a higher speed than NAND-type devices (column 1, lines 28-32). It would therefore be obvious to implement the device of Hong with a common source line and a conductive bit line that is connected to the drain of each memory cell in a row in order to attain the benefit of a high speed memory.

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22. Claims 73, 74, and 76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong (USPN 5,770,501) in view of Shih et al. (USPN 6,362,035 B1) and further in view of Vassiliev et al. (USPN 6,180,490 B1) and further in view of Yoo et al. (USPN 5,747,848).

23. In reference to claims 73 and 74, figures 6a-6f of Hong (USPN 5,770,501) disclose a device which meets the claim. Figures 6a-6f illustrate a substrate (50) with a field oxide region (542) in a trench. There is a tunnel oxide layer (512) formed on the substrate (50) adjacent the field oxide region (542). Hong does not disclose the use of a sloped isolation trench. However the use of a sloped isolation trench in a nonvolatile semiconductor device is well known in the art. Shih (USPN 6,362,035 B1) discloses that using a sloped isolation trench prevents the formation of voids in the isolation material within the trench (column 3, lines 52-55). Furthermore Vassiliev (USPN 6,180,490 B1) discloses that the presence of voids can lead to an undesired electrical shorting (column 2, lines 16-22). In view of Shih and Vassiliev, it would therefore be obvious to use sloped isolation trenches in the device of Hong. There is at least one floating gate layer (514a) formed over the tunnel oxide layer (512). There is at least one polysilicon structure (552) formed adjacent to the at least one floating gate layer (514a). This polysilicon structure or ear increases the capacitive coupling of the memory cell. Hong does not disclose the use of a conductive bit line which is connected to the drain of each memory cell in a row in conjunction with a common source line, otherwise known as the NOR configuration. However it is well known in the art to implement a flash memory in this manner. Yoo et al. (USPN 5,747,848) discloses that NOR-type

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devices have a higher speed than NAND-type devices (column 1, lines 28-32). It would therefore be obvious to implement the device of Hong with a common source line and a conductive bit line that is connected to the drain of each memory cell in a row in order to attain the benefit of a high speed memory.

24. With regard to claim 76, figures 6a-6f of Hong shows that the polysilicon structure or ear is formed adjacent to the field oxide region (542).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kevin Quinto whose telephone number is (703) 306-5688. The examiner can normally be reached on M-F 8AM-5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on (703) 308-6601. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7722 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

KVQ


Minhioan Tran
Primary Examiner
Art Unit 2826